

Weather Accident Prevention Project Review

September 20 & 21, 2005

Williamsburg, VA

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NASA Langley Research Center
Hampton, VA**



Objectives of Review



Weather Accident Prevention Project

- **Communicate progress to NASA's stakeholders, partners and customers**
- **Encourage and strengthen NASA's collaboration with the aviation community**
- **Provide final reporting of accomplishments**



Previous Reviews

Weather Accident Prevention Project

- **May 2000, Hampton, VA - Ron Colantonio**
- **June 2001, Cleveland, OH - Shari Nadell**
- **November 2002, Lexington, MA - Gus Martzaklis**
- **June 2004, Las Vegas, NV - Gus Martzaklis**



Agenda

Weather Accident Prevention Project

Tuesday

- **Project Overview**
- **Perspectives**
 - Program
 - Commercial Transport
 - General Aviation
- **Aviation Weather Information**

Wednesday

- **Turbulence Prediction and Warning Systems**
- **Awards Luncheon**
- **Weather Information Communication**
- **Concept of Use**



Safety Projects - Complete FY05

Weather Accident Prevention Project

Vehicle Safety Technologies

Synthetic Vision

Provides commercial & general aviation pilots with clear-day operations all of the time



Accident Mitigation

Increases survivability when accidents occur



Single Aircraft Accident Prevention

Develops health management & robust control technologies to enable aircraft that are "self healing" & "refuse to crash"

Weather Safety Technologies



Weather Accident Prevention

Brings intelligent weather decision-making to every cockpit



Icing Research

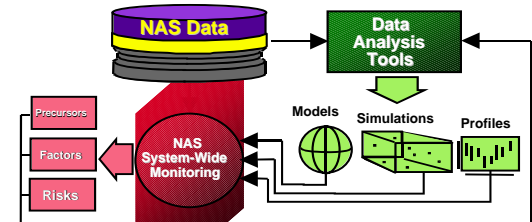
Icing detection and protection systems, training aids, tools for design and certification of aircraft systems

System Safety Technologies

Aviation System

Monitoring & Modeling

Monitors and assesses data from every flight for known & unknown issues



System-Wide Accident Prevention

Improves human/machine integration in design, operations, & maintenance





Program Organization (FY00-05)

Weather Accident Prevention Project

Aviation Safety & Security Program Office*

George Finelli, Program Manager

Laura O'Connor, Deputy Program Manager

Technical Integration

Frank Jones
(LaRC)

Program Integration

Michael Basehore (FAA)

1.3

Vehicle Safety Technology

2.3

Single
Aircraft
Accident
Prevention
Carrie Walker
(LaRC)

2.6

Synthetic
Vision
Mike
Lightfoot
(LaRC)

2.5

Accident
Mitigation
Robert
McKnight
(GRC)

1.4

Weather Safety Technology

2.4

Weather
Accident
Prevention
Paul Stough
(LaRC)

2.7

Aircraft Icing
Mary Wadel
(GRC)

1.5

Systems Safety Technology

2.1

Aviation
System
Monitoring &
Modeling
Irving Statler
(ARC)

2.2

System-Wide
Accident
Prevention
Sandy Hart
(ARC)

Aviation Weather
Information
(AWIN)
Paul Stough (LaRC)

Weather Information
Communications
(WINCOMM)
Mike Jarrell (GRC)

Turbulence Prediction
& Warning Systems
(TPAWS)
Jim Watson, (LaRC)
Rod Bogue, Dep (DFRC)

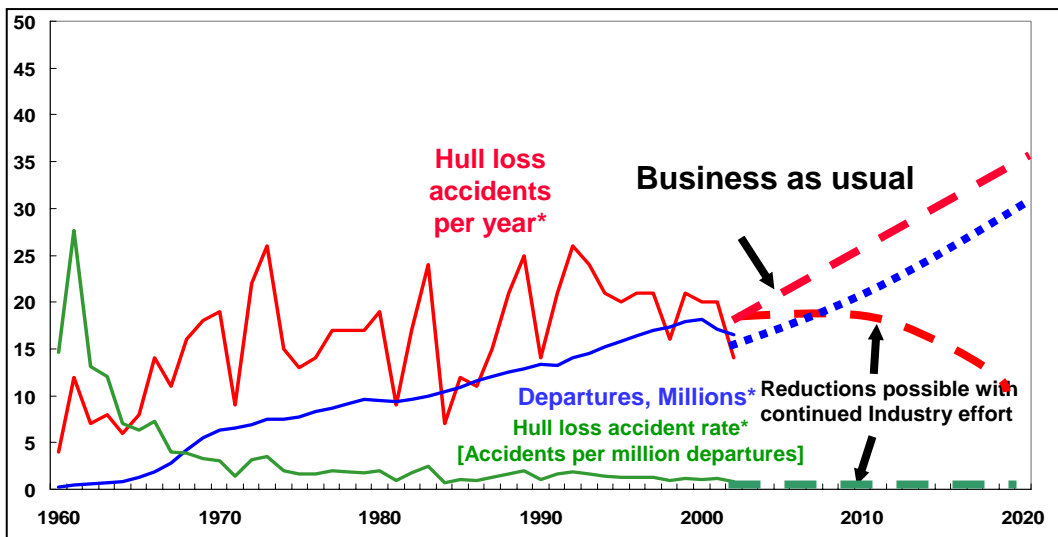
**Note: Security Projects Not
Shown (FY04-08)*



Weather and Aviation Safety

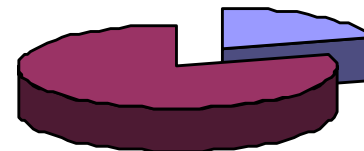
Weather Accident Prevention Project

NASA Aviation Safety Goal: Develop and demonstrate technologies that contribute to a reduction in the aviation fatal accident rate by a factor of 5 by year 2007.



*Accident and Departure data through 31 December 2002

Non-Turbulence-related Injuries (67%) Turbulence Injuries (33%)
Ranked #1 for Injuries



Commercial Transport Serious Injuries 1990-1996

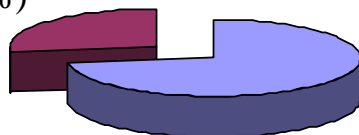
Fatal/Non-fatal Accidents

Source: NTSB Data

41% during cruise

27% due to visual flight operation in instrument flight conditions

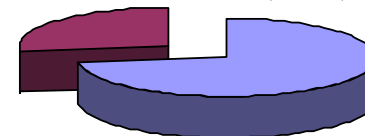
Weather-related (27%) Non-weather-related (73%)



GA Aviation Accidents 1982-1993
 (22,053 total accidents)

Source: AOPA Air Safety Foundation

Weather-related (33%) Non-weather-related (67%)



Commercial Carrier Accidents 1983-1995

Source:NTSB



Goals and Objectives

Weather Accident Prevention Project

Goal: Develop enabling technologies to reduce weather-related accident causal factors by 50% and turbulence-related injuries by 50% by the year 2007.

Objectives:

1. Improve pilots' ability to obtain, understand and use weather information for safer decision-making.
2. Develop means to expand automated airborne in-situ weather reporting for altitudes below 25,000 ft. for improved forecasts.
3. Develop en-route turbulence hazard prediction and warning technologies for reducing injuries to passengers and crew.
4. Develop air/ground communications concepts and technologies for improved weather information dissemination.
5. Develop methods to use advanced satellite weather-observation capabilities to improve aviation weather products.

Technology Products



Weather Accident Prevention Project

- Datalink Cockpit Weather Information Systems

- General Aviation systems
- Commercial Air Transport systems

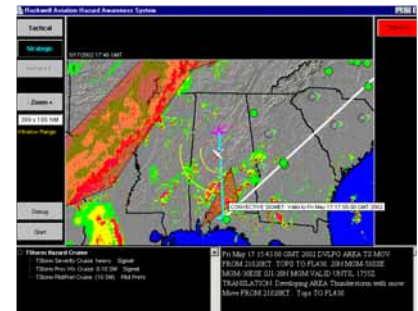


- Cockpit Weather Technologies:

- Interface Technologies & Display Guidelines:
 - Presentation, decision aiding, flight planning tools

- Information Acquisition & Conditioning Technologies:

- Information fusion, enhanced on-board radar, Advanced Satellite Aviation-weather Products (ASAP)



- Airborne Weather Sensor Technologies

- Tropospheric Airborne Meteorological Data Reporting (TAMDAR)

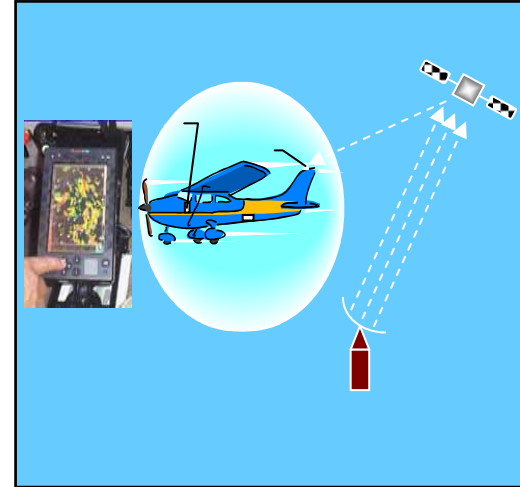




Technology Products (continued)

Weather Accident Prevention Project

- Weather Communications Technologies:
 - National Weather Dissemination Capability for
 - Air Transport
 - General Aviation / Regional Carriers
 - Global Weather Dissemination Capability
- Turbulence Technologies:
 - Turbulence Modeling & Simulation
 - Airborne Turbulence Sensors
 - Turbulence In-Situ Systems
 - Turbulence Prediction Algorithms & Hazard Metrics
 - Flight Deck Integration
 - Enhanced Autopilot Concepts for Turbulence Ride Smoothing
 - Certification Methods & Tools





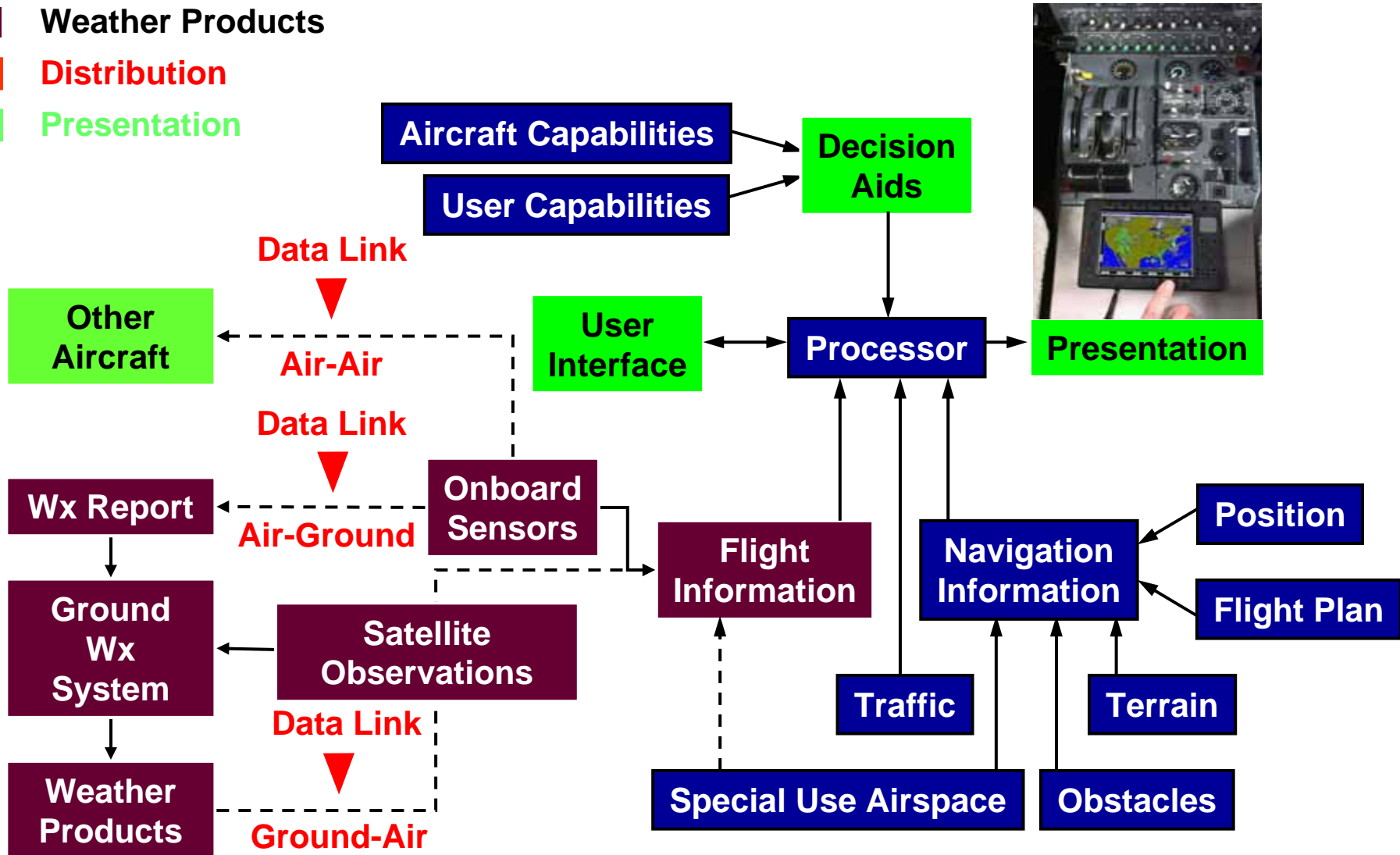
Products and the Decision Process

Weather Accident Prevention Project

Weather Products

Distribution

Presentation

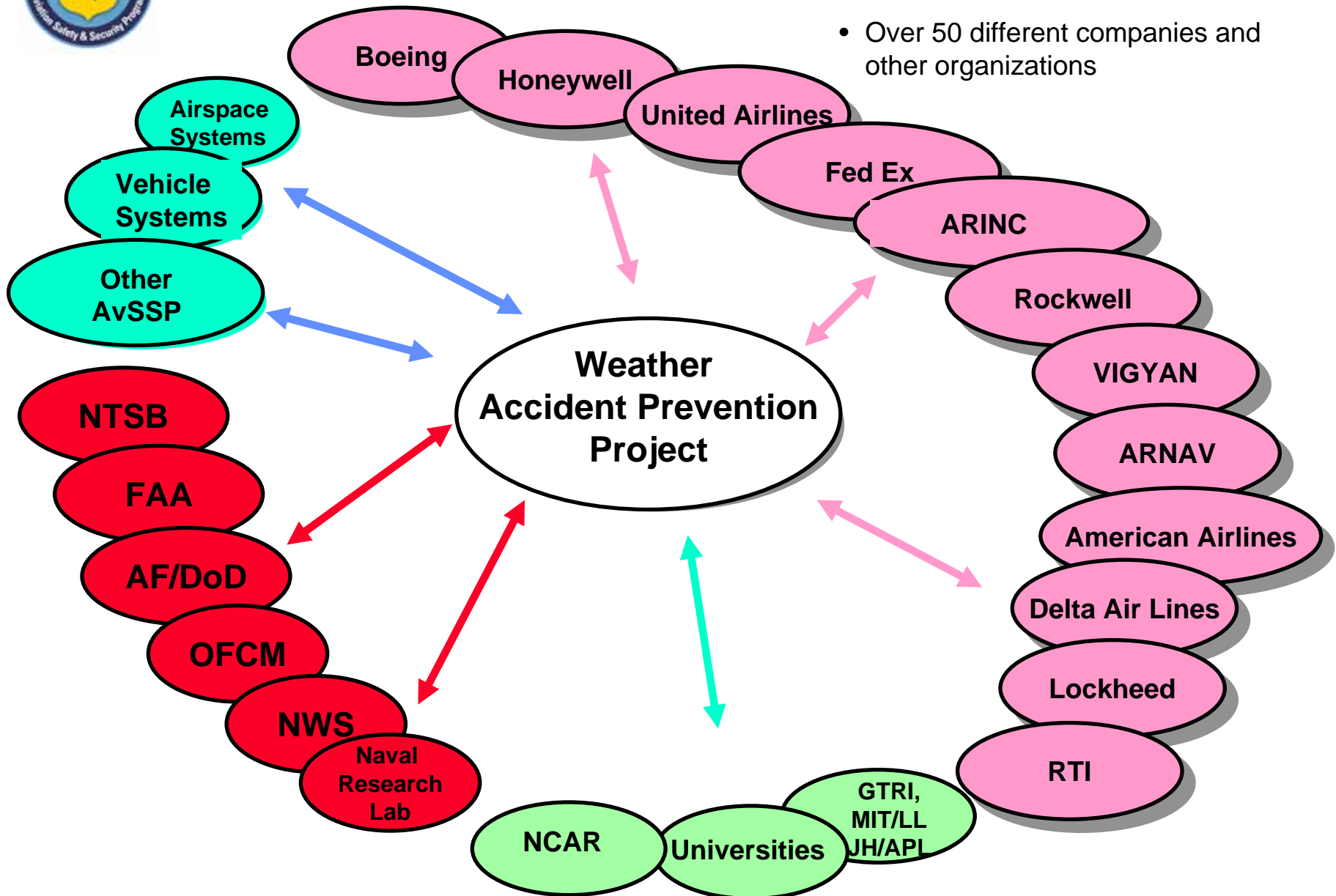




Partners

Weather Accident Prevention Project

- Over 50 different companies and other organizations





Key Accomplishments as of 2004 Review

Weather Accident Prevention Project

- ✓ First generation cockpit weather systems and data links commercialized!
- ✓ Radar-based turbulence warning technology validated via NASA flight tests.
- ✓ First generation turbulence LIDAR characterized.
- ✓ Prototype airborne weather sensor (TAMDAR) validated on research aircraft.
- ✓ Benefit studies of satellite-enhanced aviation weather products completed.



Plans (FY04-05)

Weather Accident Prevention Project

- Complete next-generation presentation and decision-aiding research and validate via transport and G/A flight experiments
 - Perform air transport simulation experiment, integrating turbulence warning display concepts, and migrate to B-757 for flight evaluation with commercial pilots
 - Validate G/A research via NASA C-206 flights
- TAMDAR:
 - Conduct fleet evaluation of TAMDAR sensors with Mesaba
 - Integrate sensor and data link system for TAMDAR system validation on-board NASA C-206
- Validate selected target weather communications architectures via flight experiments (UAT, 1090, VDL Mode 3, Satcom)
- Perform in-service evaluation of turbulence radar system with Delta
- Flight evaluate turbulence hazard reporting system via NASA and Delta experiments
- Perform field evaluation of ASAP in-flight icing algorithms



New Terms

Weather Accident Prevention Project

- **AWIN**
- **TAMDAR**
- **ASAP**
- **TPAWS**
- **E-Turb Radar**
- **TAPS**
- **WINCOMM**



Summary

Weather Accident Prevention Project

- **Project concludes September 30**
- **Significant accomplishments**
 - AWIN
 - TPAWS
 - WINCOMM
- **Technologies implemented**



Web Site

Weather Accident Prevention Project

<http://wxap.grc.nasa.gov>

